Adaptive Cycling

INSTRUCTOR'S MANUAL

AN INTRODUCTORY MANUAL AND RESOURCE ON
CYCLING FOR INDIVIDUALS WITH DISABILITIES

Sponsored by

DISABLED SPORTS USA

VA U.S. Department of Veterans Affairs

AUTHOR/EDITOR

David Lee, MS, CTRS/L
Northeast Passage
Durham, NH

CONTRIBUTORS

Greg Milano
BORP Cycling Program
Berkeley, CA

Patrick Addabbo
Adaptive Sports Center
Crested Butte, CO

Scott Moro
Ride2Recovery
Calabasas, CA

Connor Inslee
Outdoors for
All Foundation
Seattle, WA

Ian Lawless
Paralympic Cycling
Colorado Springs, CO

Endorsed by

ADAPTIVE SPORTS CENTER

BORP ADAPTIVE SPORTS

RIDE 2 RECOVERY

outdoors for all FOUNDATION

TABLE OF CONTENTS

INTRODUCTION

Cycling provides many benefits for participants — and, with the availability of many different types of bikes, trikes, and tandems, it is an activity that almost everyone can participate in.

This manual is designed to provide an understanding of individuals with disabilities, providing cycling instructors with information about the different types of cycles available and the information needed to run a successful adaptive cycling program. It will also address different abilities and how to best fit the individual to the right bike for their strength and desired level of riding.

There is such a vast array of cycling companies, accessories, and techniques that we could never cover them all in this manual. We present the major types of equipment and the accessories you are most likely to need, with tips throughout to get your program off to a good start.

Use this manual to learn which bikes may be appropriate for each client before they ever get on the bikes. It is very meaningful for someone who comes to ride for the first time, when the first bike you put them on is the best one for them! Skill at selecting a bike is learned with experience; in time, when you see a person walk or roll over to you, you will have a good idea of what bikes to suggest, to provide the most successful experience. Make sure they try out several, to see some of the differences between the bikes. Often, people will come back to the first bike they try — but they may like a feature of one bike and something else from another. Often you can combine those features, or find a bike that has both elements.

Safety must always be your number one priority when running a program. With cycling at speed, accidents can result in serious injury. Educate riders, staff, and volunteers to make riders as safe as possible. Adaptive cycling programs should be conducted only with well-trained staff and volunteers, in a cycling environment that is appropriate for the skill level of the participants.

Helmets should be a mandatory requirement in any program. Also, because many adaptive cycles are low to the ground and difficult to see, safety flags should be used *at all times* to increase visibility. All riders should also be instructed on braking and steering and should be asked to perform on command braking and steering tests. For a rider whose ability to steer or brake is compromised, set up cycling practice in a controlled setting, or have another rider join them on a tandem setup to ensure safety. Riders should wear any protective clothing needed, and be prepared for the activity they are involved in (using sunscreen, carrying water, etc). Water, snacks, and first aid kits should be available at any event.

The terms *bikes*, *trikes*, and *cycles* will be used throughout this manual, and "bikes" is also used as a generic term for all types of self-powered rides.

BIKES, TRIKES, AND TANDEMS

Several styles of bikes are available to riders. Depending on ability, some riders may be able to use several types.

This section describes each style to help you determine what bike would be appropriate for an individual and to indicate how you can adjust the bike to meet their needs. Every rider is different: a "typical" setup for one person with a specific impairment may not be the best setup for another person with the same impairment. Having options is crucial to providing a successful experience for each person.

LIMITING FACTOR - BALANCE:

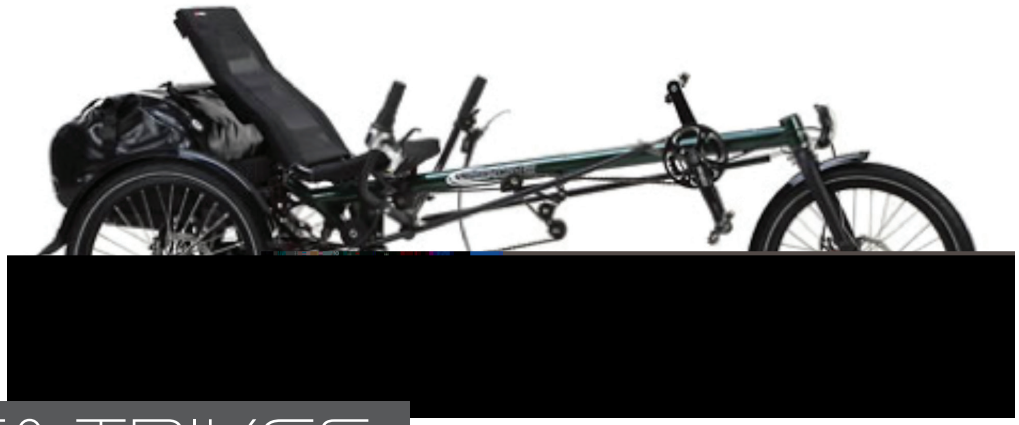
Often, the rider's most limiting factor is balance. For this reason, most of the adaptive cycles are low to the ground, increasing the stability of the equipment. These lower style bikes are called recumbents — bikes that position the body with the feet at about the same height as the seat. These bikes have a higher performance potential and maximize safety by increasing stability. The following factors also enhance stability.

Wheel Width: Wheel width helps with balance, but it can also be a limiting factor. Excessive wheel width can make the bike difficult to navigate in tight places and can also be dangerous on narrow trails and roadways. Most bikes have a wheel width less than 32", providing a wide but not excessive footprint.

Speed & Stability: Trikes allow the rider to ride even at slow speeds. As the three wheels maintain balance for the rider, they can accompany someone at walking speed and easily stop without fear of tipping over. This stability also allows the rider to get going, take breaks as needed, and finish a ride without needing to plant a foot. This is very important for those with joint replacements or insecure joints, or those who need extra pedal support to keep their feet in place on the pedals. The trike allows people who are worried about their balance or the problem of insecure joints to get back into riding with peace of mind.

Youth Trikes: Youth trikes are available from many manufacturers in different styles. Decisions on trikes for youth are similar to those for adults, but also consider simplicity, as young riders are generally less experienced. A simpler braking and gearing setup will help ensure a positive, safe experience.

Tandems: Incorporating another rider on a tandem bike can compensate for a client's insecure balance.



DELTA TRIKES

DELTA TRIKES:

Recumbent trikes **(leg powered)** are found in two styles, **delta** and **tadpole.** Delta style trikes have one wheel in front and two behind. These bikes are generally very maneuverable, comfortable, and easy to get on and off. Steering is usually at the hips, but can also be with a standard handlebar setup. The chain goes from the cranks to the rear of the bike, to power one or both wheels.

Transfer: To transfer onto the bike, the rider approaches the bike from the side, turning the front wheel towards the rider, and then sits (with or without assistance) and swings one leg over the boom (the main frame in front the of seat). Getting off the bike is the same but in reverse: the rider puts one leg over the boom, brings their feet under them as far as possible, and stands up. Some people may want to stop next to something (park bench, car, signpost) that they can grab to help them rise from the seat.

Adjustments: Basic adjustments on these bikes are similar to other foot-powered bikes, but depending on the person's ability, flexibility, and strength the settings may change.

Positioning: The legs should be slightly bent to prevent the knees from locking. This can be done by lengthening/shortening the boom or adjusting the seat.

Bikes with a Boom: lengthening or shortening the boom will require a steering adjustment, as the steering linkage changes when the boom length is changed.

Chain Adjustment: Unless the bike has a "chain gobbler," the chain will also have to be shortened or lengthened. Chain gobblers are highly recommended for program bikes as they make adjustments much easier.

Seat Backs: On some bikes, seat backs are also adjustable and can be set to a comfortable position for each rider; this includes recline and height adjustment. Many riders like to sit more upright, but this can limit the upper leg range of motion. It is important to find a setting that is comfortable for the rider that still allows them to pedal comfortably. Also, raising the height of the seat will raise the center of gravity of the bike. This could make the bike more comfortable and easier to ride, but will also decrease the stability of the bike. A lower seat height/center of gravity will increase the stability of the bike.

Steering Handles: These can also be adjusted on some bikes, forward/backward or closer/further from the seat. Handles should also be adjusted for comfort and usability for the rider. You will want to ensure that the rider can access the full steering range, gears, and brakes.

Options: There are many options available on these bikes, including seat belts/shoulder harness, suspension, and tandem attachments to connect to other delta style trikes.

Seat to Crank Height Variation: Different brands and models have differences in the height of the seat relative to height of the crank and pedals. This position can make a big difference in a rider's comfort and ability to pedal. So if one bike doesn't work for someone, try another.

Internal rear gear hub (typically 7sp): is a great addition that will allow the bike to roll backwards more easily, for example, when a rider is turning around. It prevents the rear derailleur from bending when rolling backwards, due to a change in the alignment of the chain (aligning on the wrong cassette cog as the chain moves in the opposite direction).

EXAMPLES: HASE KETTWIESEL, HASE LEPUS, HASE TRETS (JR.),
GREENSPEED ANURA, SUN EZ-3, SUN EUROS, TRAILMATES

TADPOLE TRIKES:

Tadpole trikes have two wheels in front and one behind. These bikes are generally the lowest, most stable bikes, with a wide wheelbase and low center of gravity. This allows them to be very stable at higher speeds and offer higher performance than delta style trikes.

Steering: of these bikes is at the hip; both front wheels turn. Brakes are also on the front wheels. The unmodified braking system is often set up so the right wheel is braked with the right hand and left wheel with the left hand. This can be problematic for a rider who can only brake with one hand. Modifications can easily be made to a double-pull brake lever, allowing the rider to brake both front wheels with their dominant hand. Another option is to use a cable doubler.

TADPOLE TRIKES

BIKES, TRIKES, AND TANDEMS

Transfer: Transferring onto a tadpole trike can be a bit of a maneuver, due to the extension of the cranks and the two tires in front. The rider should approach the bike from the front and walk backwards into the space between the boom and wheels. From this position, some people find it best to step over the boom before sitting. Or, they can sit and then swing one leg over the boom. The seats on these bikes are low, so it is good to assist the rider the first couple of times getting onto the bike. Getting off the bike is the same process in reverse: The rider puts a leg over the boom and stands up between the boom and one of the front wheels. Some people may want to stop the bike next to something (a park bench, car, signpost) that they can use to help rise from the seat.

Adjustments: Adjusting a tadpole trike fairly straightforward, as the steering linkage is behind the boom length adjustment. On these bikes, typically, seats do not move forward or back; all adjustments come from the boom length. Recline and height are adjustable on some models, allowing the rider to dial in their preferred position.

Chain Adjustment: Unless the bike is equipped with a chain tensioner, the chain length will also need to be adjusted when the boom length is adjusted. If the chain is not adjusted, riders will lose access to some gears, as there will not be enough chain length to access them all (chain will bind). Alternatively, excess chain can drag or get caught up in the rear derailleur.

Positioning: The legs should be slightly bent at full extension, to prevent knees from locking.

Steering Handles: These are also adjustable forward/backward or closer/farther from the seat, adjusted for comfort and usability for the rider. Ensure that the rider can access the full steering range, gears, and brakes.

Seat Backs: On some bikes, seat backs can be set to a comfortable position for each rider, including recline and height adjustment. Some riders like to sit more upright, but this can limit the upper leg range of motion. It is important to find a setting that is comfortable for the rider and still allows them to pedal comfortably. Also, raising the height of the seat will increase the center of gravity of the bike. This could make the bike more comfortable and easier to ride but will also decrease the stability of the bike. A lower seat height/center of gravity will increase the stability of the bike.

Options: As with delta trikes, many options are available for one-hand operation. Grab bars that extend off the kingpins can aid in sitting or standing. For many people, a headrest can be an added comfort.

Internal rear gear hub (typically 7sp) is a great addition that will allow the bike to roll backwards more easily when a rider is turning around, similarly to the delta trike.

The *rear wheel* on tadpole trikes is also the drive wheel. This provides added traction when climbing or on soft terrain, as the weight of the rider shifts toward the back wheel. For this reason, this can be a good off-road trike for loose and gravel roads. However, in addition to being difficult for some to get on, the tadpole derailleur has minimal ground clearance, so extra care should be taken on off-road areas.

SAFETY CONSIDERATIONS FOR RECUMBENTS: HELMET, FLAG, SECURED FEET/PEDALS WITH HEEL CUP

EXAMPLES: GREENSPEED GT SERIES, GREENSPEED MAGNUM, CAT TRIKE, TERRA TRIKE, WIZ WHEELS, ICE TRIKES

SPECIALIZED ADJUSTMENTS FOR FOOT-POWERED TRIKES

One Hand Operation:
The most common changes made to the foot-powered trikes (besides basic adjustments) are for single-handed operation.

Whether because of weakness due to a stroke, limited grasp, limited hand function or another aspect of their disability, many people find that having all the controls on one side increases ability and safety while riding.

For most bikes, a double-pull brake lever can be installed to operate both brakes with one hand. For shifting, a combination of grip shift (for the front derailleur) and bar end shifter (for the rear derailleur) can be used to operate both front and rear shifters, if so equipped. Bar ends can also be added to the steering bar to allow for similar shifters (creating two bar end shifters).

To be successful and minimize frustration, the shifter arrangement must accommodate the physical and/or cognitive ability and the dexterity of the rider. There are many styles of shifters available to choose from.

Adapted Pedals:
The use of adapted pedals is recommended for most people using the recumbent style foot-powered trikes.

These pedals should include a heel support and should keep the foot on the pedal with straps, buckles, or bungee cord. This ensures that the feet stay on the pedals instead of slipping off, which could result in feet and lower legs being rolled over by the bike and cause serious injury to the foot, ankle, and/or leg.

Clip-less pedals are also an option, if the rider is able to secure their feet and release when needed. Clip-less pedals require special compatible bike shoes.

BIKES, TRIKES, AND TANDEMS

Clip-less Pedal:
Platform pedals with heel cups are a must. If a rider has difficulty keeping the foot straight, a platform pedal can help keep it aligned. This can keep the foot on the pedal and prevent the heel from hitting the chain and crank arms. Platform pedals can be used on the left or right side and in combination with other style pedals. Some platform pedals also offer calf support, which can help people with limited strength or paralysis keep their knee in alignment with the pedal. For some riders, often those with CP or stroke-related symptoms, the legs tend to bend inward, making pedaling difficult and uncomfortable. The calf-support pedal solves this problem.

Shortened Cranks:
Crank length makes a huge difference in a person with limited range of motion to power a bike. The standard length for many bikes as delivered is 165–175 mm, which is often too long for recumbents. A shorter crank length means that the legs do not have to be extended fully or bent as far, which is a benefit for some riders. Cranks can be replaced, or "crank shorteners" can be attached which offer a range of settings. If possible, when ordering trikes, request 155mm length cranks.

Fixed Gears:
Some recumbent trike models are available with "fixed gears" (Freedom Concept Adventurer Series). A fixed-gear cycle cannot coast unless the pedals are moving; if the bike is moving, the rider must pedal. If the rider pedals backwards, the bike travels in reverse. Fixed-gear bikes can only have one gear. Some riders cannot maintain a full pedal stroke with their legs, so they need the momentum of the fixed gear to help them keep pedaling. Some people also need the ability to reverse-pedal, to maneuver the bike if their feet are strapped in and they do not have the arm strength to use their hands to reverse. A new rider may need a fixed gear to begin riding, but may develop the muscle strength and coordination to graduate to a free wheel.

Fixed Gear Safety: Riders on fixed gear bikes should avoid downhills, as they may not be able to control the speed of the bike with their legs and may lose control. These bikes should always have regular brakes as well, and the rider should be able to activate the brakes. Otherwise, these bikes should be used only at very slow speed and on flat courses so the rider does not lose control.

TANDEMS

TANDEMS:

Tandems are a great option for many people, including those with a visual impairment, cognitive deficit, or limited strength, or people wanting to get more out of their experience who need or want the support of another rider. Tandems are also a great way to get people out who do not have the ability to power a bike, tandem, or other bike on their own.

There are many types of tandems, from conventional two-wheel tandems to trikes, recumbents, and others. There is even the possibility of linking three or four recumbent delta trikes by using universal couplings (a front wheel mount attached to the rear of a delta trike).

Traditional Tandems: Traditional tandems are readily available and can be found for rent at many bike shops. These bikes offer a traditional bike setup for both the front and rear rider. The front rider is in control, and together they power the bike. Unless specially equipped, the front and rear riders need to pedal and rest simultaneously.

Setting up an individual with a disability can be tricky on a two-wheel tandem. These tandems can work well, however, for those with a minor physical disability, amputation, or visual impairment.

Typically, the rider with a disability will be the stoker (rider in back), while the guide will be the captain (rider in front). Practice and good communication will be needed, as starting off is tricky especially with inexperienced riders. There are many ways to start off a tandem from a stop, and this usually depends on the personal preference of the captain. Generally, the stoker will be in place, ready to go, with the right pedal in a downstroke position. As the captain pushes off, they both pedal down to the bottom position. The captain gets on the seat, and with a slight pause they begin pedaling together.

EXAMPLES: SCHWINN TANDEMS, BURLEY TANDEM, HASE PINO, BUDDYBIKE

Recumbent Tandems: Recumbent tandems are available in three wheel designs. These bikes allow a rider that needs assistance to be set up without the bike tipping over. These bikes can also be modified as needed to allow riders the best experience for their ability. Options for these bikes are the same as with the other recumbent trikes (delta and tadpole).

The three-wheel trikes also provide a sense of security through increased stability at any speed. The downside to tandem recumbents is their length. This makes them very difficult to transport, without major alteration to the bike or carrying vehicle. The turning radius is also very large due to the long wheelbase.

EXAMPLES: GREENSPEED GTT, TERRA TRIKE TANDEM

COUPLED DELTA TRIKES

COUPLED DELTA TRIKES:

Two or more delta style bikes can be connected to form a tandem. This is done with a coupling mounted to the back of one delta trike that secures to the front fork of the second trike. This coupling is designed to have some movement -- when the pair turns, the coupling rotates enough to allow the second bike to turn as well. Also, each trike has a separate drive train, allowing the two riders to be using different gears (or not pedal at all). On a one-piece recumbent tandem, the two riders are linked together and must pedal in sync.

The coupling allows the bikes to be ridden either solo or connected together. The advantage of this option is that, if a rider becomes tired or is unable to handle certain terrain, the bikes can be connected at any time to provide an assist, and then disconnected when the rider feels able to manage solo. At this time, only Hase and Greenspeed make couplers for their trikes, so the front bike needs to be one of these models; the rear trike can be any model delta.

Important Note: When using the Hase universal coupling bolted to the back of the Hase Kettwiesel or Lepus trike, the Hase universal coupling **should not be tightened completely**. *Use manufacturer's recommendations, as an over-tightened coupling will result in damage and can even disengage the tandem setup.*

EXAMPLES: 2-HASE KETTWIESEL, 2-GREENSPEED ANURA (OR COMBINATION OF 2 DELTA TRIKES)

SIDE BY SIDE TANDEMS:

Side-by-side tandems are very popular with some adaptive cycling programs. They are four-wheel cycles with two seats, side by side. Usually, one of the positions has control of the steering and brakes. Some models have independent drive and gears for each side, so that the two riders can be pedaling at different speeds or effort. Some are linked together and require the riders to pedal in sync, like a traditional tandem.

The disadvantages of side-by-side tandems are their width and the need to operate at a relatively slow speed for safety.

TANDEM TRAINING AND RIDING

Two-wheel tandems can be a very inclusive and safe part of an adaptive cycling program if done right. However, if done wrong, they can be dangerous for both riders. This can be an activity with a high degree of liability, because pilot error can be the cause of a serious accident.

For these reasons, it is recommended that tandems in adaptive cycling programs be piloted by staff and volunteers who are trained specifically in tandem riding. The following pilot training progression is given as a suggestion. Your organization should adapt it as necessary to suit your riders.

PILOT TRAINING GUIDELINES

1. **Pilot is known to be a strong and safe cyclist, riding regularly at least 25 miles a week.**
2. **Pilot joins tandem group ride as a solo cyclist to observe the group's riding behavior and familiarize themselves with the route.**
3. **Pilot is familiarized with the tandem cycle, names of parts, etc.**
4. **Pilot takes tandem solo (with no stoker) on a one-hour ride to practice controlling bike empt (Skip this step if the pilot already has extensive tandem experience.)**
5. **Pilot rides as stoker on tandem with tandem trainer. (It is helpful to do some of this riding blind folded, to simulate the experience of visually impaired riders) Practice take-off, stopping, and slow turns.**
6. **Pilot practices piloting, with tandem trainer as stoker. Practice: communication, take-off, stopping, slow turns, fast turns, bumps, wobbly stoker, slow speed lawn riding.**
7. **Pilot is trained in pre-ride safety inspection and basic road repairs: flat tires, derailleur issues, brakes.**
8. **Pilot "self-certifies" when they feel ready after practicing AND is "certified" by a designated tandem trainer by passing a road test and demonstrating ability to fix a flat and other minor issues.**

TANDEM RIDING TIPS

1. **Break the stoker in gently: practice starting and stopping before embarking on a ride.**
2. **Be more cautious than you would on a solo bike; anticipate all turns, bumps, and stops.**
3. **Announce all bumps. State, "Bump ahead," and count down: "3, 2, 1, BUMP." A solo rider unconsciously shifts weight from the saddle onto their legs for a bump, and an unsuspecting stoker could be jarred off the saddle, causing a crash, or at the least get a sore butt!**
4. **Announce shifts up or down, and power surges for hills, etc.**

BIKES, TRIKES, AND TANDEMS

ASSISTED RIDING AND THERAPEUTIC CYCLES

Some cyclists will need to use bikes designed to be assisted by a walking or cycling assistant because they do not have the muscular coordination to pedal, steer, or brake independently. Although most of these bikes are designed for people with physical disabilities, they can also be used by riders with cognitive or developmental disabilities who cannot ride independently.

Assisted Cycles: are usually three-wheel trikes. They come in a variety of sizes, for very small children to large adults. Many of them have a traditional upright tricycle posture with the pedals under the seat, but some are more recumbent. Usually they have seatbelts and torso support for full body support in the seat, as well as adaptive pedals.

They will have a bar behind the seat which the assistant can use to push and often to steer the bike. In most cases, it is REQUIRED that the assistant never release their control of the bike, because of their instability.

Assisted Tandems: Freedom Concepts makes a very large, upright tandem trike which is controlled from the *rear* position. The front pedals can be either engaged to follow the lead of the rear pedaler or disengaged for coasting. These bikes, while, large and expensive, can provide a high quality experience for youth and parent riding together.

Fixed Gears: Most assisted-use bikes have "fixed gears." This means that the cyclist cannot coast without moving their legs. If the bike is moving, their legs are forced to move in the pedaling motion. If the bike is reversed, their legs move in reverse. This can be good for people who benefit from therapeutic stretching of their legs. Also, some riders who can pedal need the initiation movement of the fixed gear.

Fixed Gear Safety Concerns: Because the pedals are moving, injuries can occur if feet come loose from the pedals or clothing gets caught in the chain. Assistants should be extra observant of riders' feet, legs, and clothing, and maintain close communication when using these bikes.

General Safety Concerns: These trikes usually have a high center of gravity and can tip over easily. They should be used with caution and almost always with hands-on assistance. They should only be used on smooth, flat terrain. It may be best to have the rider's therapist or caregiver present, to assist with a safety assessment, though some adults may know their limits and be able to provide you enough feedback independently. Often, clients will have used this type of bike previously in a therapeutic setting.

EXAMPLES: 2-HASE FREEDOM CONCEPTS, AMTRYKE, RIFTON

REAR CONTROL TANDEMS

Rear Control Tandems: Rear control tandems are two-wheel tandems which are steered and controlled by the person in the rear position (the captain or pilot). They have the advantage that the passenger sits in view of the captain and is in a position that allows easier communication. They are sometimes the best option for cyclists with cognitive disabilities, riding with a parent or staff member. There are only a few models available. On a two-wheel tandem, the pilot needs to be a skilled cyclist who can balance the front rider.

The Frank Mobility Duet: This is a two-wheeled bike. The rider's seat is mounted in the front of a standard position bike, allowing the captain (seated behind) to ride easy terrain with a passenger. The rider up front has no control of the bike, but can have the sensation of biking and being with others in a cycling activity. These bikes are also often used with elderly participants, giving them a greater sense of movement and allowing them to participate on some level in an activity they may have enjoyed in the past.

The Hase Pino: This is also a front-seat tandem, but the rider in front has the ability to pedal. The front seat on this tandem is in the recumbent position, while the captain in back rides in a conventional position. A heavy duty kickstand allows the rider to be set up safely, and the proximity of the two riders makes communication much easier than on a traditional tandem. Many options are available for the front rider, including child length boom, pedals, harness, and handles, and even a hand-cycle adaptor..

The Buddy Bike: This bike looks like a traditional tandem but has large handlebars that wrap around to the rear rider, so the rear rider can control the bike while communicating with and balancing the front rider.

The Freedom Concept Tandem Trike: is a very large trike with both riders in the upright position. It is very popular with riders who need high levels of support. The rear rider is the pilot and steers. The front rider can either be forced to pedal along or allowed to coast, depending on the gear setup. (See the paragraph on page 14 on fixed gears.)

EXAMPLE: FRANK MOBILITY DUET, ZIGO, HASE PINO, BUDDY BIKE, FREEDOM CONCEPT TANDEM

TWO-WHEEL BICYCLES

Many people with disabilities will still be able to ride on traditional two-wheel cycles. Two-wheel bikes are inherently more dangerous than three-wheeled cycles because of the greater possibility of a fall. Also, teaching individuals to ride two-wheel cycles often requires very individualized and patient coaching (sometimes over several sessions).
For these reasons and others, many adaptive cycling programs choose not to offer two-wheeled cycling as part of their programs. Find out if your community has a cycling organization that focuses on learning to ride a two-wheeled cycle; this may be a good resource for some adaptive cycling clients.

If you choose to offer two-wheel cycle coaching, the following sections provide some examples of teaching techniques and the modifications that can be made to cycles. The amputee community in particular has been developing cycling modifications for many years; many examples of modifications can be found online. Whether or not your organization offers a particular modification, you can still educate potential riders about the possibilities that exist.

Teaching Techniques:

Scoot Biking: Most kids today learn to ride on "scoot bikes" without pedals. This technique can be used for both kids and adults. On a scoot bike, the seat is low enough for the rider to touch the ground with both feet so they can push off and coast. It's a great way to learn and practice balance without committing to feet on the pedals. Scoot bikes are available in all sizes; you can also just lower the seat on a regular bike and remove the pedals.

Low Seat: When a rider has mastered the scoot, the next step would be a bike with pedals but with the seat low enough for their feet to touch the ground. The seat can be raised gradually as they gain skill and balance, until it reaches a more comfortable height.

Two-Person Spotting: When a rider is first starting out, have two staff spotting, one on either side of the rider, to prevent a fall. Keep in mind that there is a limit to how long a spotter can jog next to a cyclist, so eventually they will be riding without a spotter and have the risk of falling.

Stopping: Coming to a stop without falling can be just as hard as starting. Be sure to have cyclists practice stopping in a controlled area, with spotters.

Lawn practice: Riding on a firm grass field can be a safer option for a new rider. It also has the benefit of being slightly harder to ride on than pavement, so when they can ride on the grass, they may be ready for the road.

Road Safety: There are many resources available for teaching safe cycling skills for roads and bike paths. You probably have safety guidelines, and the internet provides many good resources.

AMPUTEES

Above the knee amputees generally find that riding with just one leg is easier than with a prosthetic, as the knee joint of the prosthesis makes it difficult.

Below knee amputees have an easier time riding with a prosthesis. This can be done with standard equipment.

In either case, people with leg amputations usually use *a pedal with a cage or clip-less pedals* to keep the prosthetic foot on the pedal and to allow their dominant leg more control, both pushing and pulling on the pedal.

Starting and stopping is the biggest challenge for these individuals. It is highly recommended that riders practice in a safe environment to learn the best technique for starting and stopping.

Arm amputations are a bit trickier to accommodate, as the controls of a typical bike are managed primarily with the hands.

Steering, shifting, and braking must all be considered for these individuals. Modifications can be made to the handlebars, but they are often cumbersome and complex. This may result in different bar shapes, different grips, and different location or style of shifters and brakes. Riders may also find that choosing a different terminal on their prosthetic may allow them to ride better.

Most often, the best modification will be to combine both brakes to one lever and mounting both gear shifters to the favored side. It can be cumbersome, however, to have two trigger shifters on one side, so a combination of styles may work well, as the rider becomes proficient using them over time. A trigger shifter, in combination with a grip shift, can allow the rider to shift both sets of gears with one hand without two levers interfering with each other. Especially with balance limitations factored in, the rider will probably need a lot of practice.

Double arm amputees can be more difficult to modify for. You will need to look at every option and what will work best for the individual, particularly for gear shifting. Road bikes will be easier than mountain bikes, as the need to shift is less often and the terrain is smoother. Braking must be instantaneous and easy to manage without letting go of the bars. This needs to be the first modification to ensure the rider will be safe.

Many people with minor or even significant disabilities may continue to ride two-wheeled bikes. We need to remember that the less we change the activity, the more attractive it will be for most people. And the price of a two-wheeled bike is much lower than an entry-level three-wheeled trike. Be sure that your riders are safe and comfortable before they go out into an environment where they may put themselves or others in danger. Peace of mind and ease of riding may motivate many riders to choose a trike — but this should be a joint decision, keeping the participant as an active member of the process.

COMMON TWO-WHEEL BIKE ADAPTATIONS FOR AMPUTEES

Programs have found that it is possible to put virtually anyone on a bike, no matter how restricted their mobility may be. With the current technology offered by the bike industry, coupled with an inventive imagination, great things can be achieved.

Here are some examples of the type of adaptations that can take someone out of a low-rider — or off of the couch — and into a life of upright riding.

Prosthetic Arms/Hands

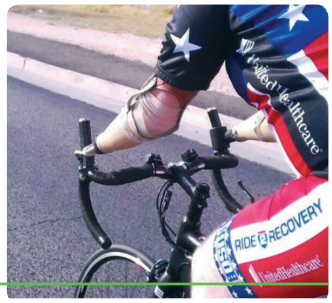
Handle Bar Adaptions: Handlebars are probably the most common adaptations, as one of the three points of contact on the bike. Changes can be made for how the rider holds the bar, and also to factor in shifting and braking.

The rubber C-85 hand is a very common adaptation that threads onto the prosthetic's quick-release fitting. This allows the rider to attach to the handle bar in a comfortable and controlling fashion. For single arm/hand amputees, it is necessary to shift all of the braking and shifting mechanisms to the other side of the handlebar; this should be performed by a professional mechanic.

FOR DOUBLE ARM/HAND AMPUTEES

an individual custom setup is required and is performed by a specialist (typically, a prosthetist with knowledge of cycling).

Double Arm/Hand Amputees



THE BUTT BRAKE

This is a custom braking system located behind the saddle, for those that are unable to use the normal braking systems on the handle bars.

Butt Brake

Post Adaptions

POST ADAPTIONS

Post adaptations are custom-made for each rider and can be mounted in almost any position on the bars.

Brake

BRAKING

One of the more common adaptations is a cable doubler. This takes one cable and turns it into two, allowing both brakes to be used by only one hand, so that braking is moved to one side of the handlebar.

Butt Brake

CUSTOM MADE SHIFTERS

Custom made shifters that are shifted with the knees for double arm amputees.

Electronic Shifting

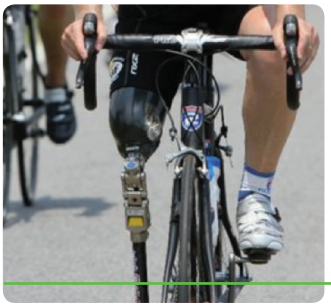
Custom Made Shifters

Custom-made shifters that are shifted with the knees, for double arm amputees

ELECTRONIC SHIFTING

Electronic shifting has changed the game for the adaptive cycling world. The electronic shifters work with the press of a button, making shifting extremely easy. The shifters can be programed to perform different functions, and can be placed in any location the rider needs.

Bartlett Legs



Free Swinging Knee

PROSTHETIC LEGS

ABOVE THE KNEE

You can work with the amputee and their prosthetic specialist to determine the correct prosthesis to be used for cycling. Below-the-knee amputees are usually easier to work with; in most cases they can be treated almost like a normal leg when setting up position. Above-the-knee amputees require very specific legs for cycling, and this has a lot to do with the motion of the knee. Often, a crank shortener will be used in the beginning for above-the-knee amputees, to allow the knee to make the full rotation of the pedal stroke. When the person has built up enough strength, the crank shortener is no longer needed. Another option is for a rider to pedal with the unaffected leg, not using a prosthetic.

ABOVE THE KNEE

The two most common legs are The Bartlett leg, which has a tensioned cord to assist the knee to make a rotation, and the Free Swinging knee.

Crank Shortners

CRANK SHORTNERS

Crank shortners are used for severe leg length discrepancies, and for above the knee amputees to allow their knee to make a smaller rotation

PROSTHETIC LEGS
BELOW THE KNEE

Below the knee amputees have very few restrictions with cycling (excluding the stump and prosthetic movement, of course). In some cases it is actually an advantage, as the ankle flexion has been removed.

Prosthetic Legs

HANDCYCLES

UPRIGHT HANDCYCLES

HANDCYCLES

Handcycles give riders who have limited or no leg function the ability to enjoy cycling.

Individuals with or without a disability may want to ride pedaling with their upper body instead of their legs, increasing upper body strength, cardiovascular health, and overall fitness. Originally designed as a fitness tool for able-bodied riders, handcycles allow people with many different disabilities to ride independently, whether around the block, in marathons, or century rides.

Handcycles can be very adjustable and there are models and styles to fit people of most sizes and abilities. There are also many different hand pedals as well as accessories to help with grip, balance, and stability.

Depending on the style, handcycles can be very maneuverable and easy to transfer onto. Higher performing styles are less maneuverable and have a lower transfer, but they are much more efficient, more aerodynamic, and suitable for hill climbing or fast paces.

HANDCYCLE STYLES

Upright Handcycles: Upright Handcycles are delta style trikes. They offer an easy level transfer from a wheelchair. These bikes are very maneuverable with the feet situated behind the front wheel allowing for a tight turning radius. This is a great bike for around the block rides, and rides of shorter distance.

Positioning: The rider sits in a chair position, with legs bent at a 90-degree angle. This makes the bikes very maneuverable, as the rider's feet are placed behind the front wheel, allowing the wheel to turn as far as needed to make tight turns. Fit the rider in a comfortable position, with feet behind the front wheel and the seat close enough to the hand pedals to fully extend the arms without rolling the shoulders forward.

Transfer: This position usually allows for an easy transfer, as the seat of the bike is at a similar height to many wheelchairs (and standard chairs). However, the easy transfer height and maneuverability have a tradeoff. Because the rider sits in an upright position, the center of gravity is higher, making this bike less stable at higher speeds. It is also a less than desirable position for maintaining greater speeds.

Gearing: The gearing is generally an internal 7-speed hub, though other options for gearing are available. This design allows for ease of shifting, as riders do not need to be pedaling in order to change gears. If a rider stops in a high gear, they can shift from a high gear to a lower gear of their choice before they move again. Therefore, this bike is a great introductory bike and good to use in tight or crowded areas, with frequent stopping.

The main upgrade to gearing on the upright style handcycles is a device called a Schlumpf drive. This is a two-speed gear system within the bottom bracket of the crank

assembly. By pressing the button that extends through the bottom bracket, you can switch between a low and high gear. This adds a low range with 7 speeds, in addition to the original high range with 7 speeds. Often this upgrade will make a rider who struggles on hills completely independent.

Adjustments: can be made to the footrest — up and down, forward and back — by using an allen wrench and adjustable wrench. The seat on these models slides on rails, like a car seat: push the lever under the seat and the seat will slide forward or back. There is no height adjustment within the seat; however, the height of the seatback can be adjusted slightly, but requires the removal of the seat back upholstery.

EXAMPLES: TOP END EXCELERATOR, TOP END LIL' EXCELERATOR, HANDY UPRIGHT HANDCYCLE

RECUMBENT HANDCYCLES

RECUMBENT HANDCYCLES

Recumbent Handcycles are available in delta or tadpole styles, delta being the most common. In general, these bikes offer much greater stability and options for performance. Aerodynamics and placement of the crank allow for better body positioning, increasing the ability of the rider and enabling them to ride longer distances and remain stable at higher speeds. These bikes are not resistant to tipping, however, so care should be taken to avoid sharp turns at speed.

Positioning: The rider's legs straddle the front wheel, with legs extended almost in a straight line with the body. The legs should be extended to the end of the footrest, keeping a very slight bend in the knee. This allows the rider to turn the bike without their legs locking (which could prevent them from turning). This leg positioning also creates some resistance, helping to keep the body from sliding forward. Of course, since every individual is different, some riders will slide anyway, in which case a seatbelt/strap may be needed.

Too much knee bend will interfere with the crank handles (pedals), especially on turns, allowing the rider to pedal only while going straight. If a rider is unable to straighten the legs, you can accommodate for this by raising the height of the crank (if available), by using a bike with wider or "s" style crank arms, or by lowering the footrest slightly.

Many of the higher end bikes have a choice of length for *crank arms*; this should be specified when ordering a personal bike. Longer crank arms increase the diameter of the rotation, which decreases gear size. Shorter cranks do the opposite, decreasing the diameter and increasing gear size. This should be addressed not according to gear size, but for proper arm length/extension. With arms fully extended, the shoulders should not roll forward. When cranks are at their closest position, the rider's hands should be about 6"–8" away from the chest. Crank arms can be selected for the optimal level of rotation.

HANDCYCLES

Seat height on these bikes ranges from around 6" to 16" from the ground. This poses a challenge to many new riders, especially in getting up off the bike.

TRANSFER:

Getting On: Come up to the seat at a 60-degree angle and put the closest leg across the seat, placing the other foot on the ground. Place the closer hand on the handcycle seat back and the other hand on the wheelchair seat. Raise both legs to place feet on footrests.

Getting Off: In most cases, angle the wheelchair against the bike seat at 90 degrees. The rider takes their legs off the footrest and tucks them up close to the seat. They then put one hand on the seat back of the handcycle and one on the wheelchair seat and transfer up. This gets easier with practice and fine-tuning of the placement of hands, feet and wheelchair. If the wheelchair is not at a 90-degree angle and right up against the seat, the distance to transfer is greater than most people can manage.

Fitting: This depends on the bike and the rider's performance level. Some of these bikes have very reclined seats (creating a prone riding style), while others have upright seats. Seatbacks should be positioned according to the riding style of the participant. Whether reclined or upright, the arms should be fully extended without rolling the shoulders forward.

A *prone position* is the most aerodynamic. However, as the power comes mainly from the arms, the rider needs to be able to use the muscles of the torso, if they are able to — which is difficult in prone position. Vision is also obstructed in this position. This position is best for races on moderate to flat terrain.

An *upright position*, with the back at or close to 90 degrees, allows for a lower crank height, providing more power from the arms and trunk. This is a more powerful position, especially for hill climbing, but aerodynamics is limited: more air resistance on flat and downhill sections reduces speed.

Most riders prefer a position somewhere between prone and upright. Recreational riders look for compromise between comfort, power, and aerodynamics. The seat position can be adjusted accordingly on most bikes. Even recreational riders can ride race-ready bikes, but with a more comfortable setup.

EXAMPLES: TOP END XLT, XLT PRO, TOP END FORCE LINEUP, VARNA SPEEDCYCLE, VARNA 2, VARNA LIBERATOR, QUICKIE SHARK, SCHMICKING, CARBON BIKE, FREEDOM RYDER FRH1

HANDCYCLE ADJUSTMENTS AND OPTIONS

Crank Position: Parallel cranks allow a rider to use their arms and upper body strength together, as in rowing. This is a more powerful and efficient position.

Opposing cranks (like on a foot-powered bike) have one side pulling while the other side is pushing. This creates a lot of rotation in the trunk: the muscles on one side of the upper body are working opposite to the other side rather than in sync. It also introduces a turning motion. Pulling on one crank while pushing on the other, results in a turn to the side the rider is pulling on (as in paddling a canoe). At the apex of the rotation, the rider then starts to turn the opposite way. This will result in either a serpentine route or sacrificing power in order to control steering.

UNIQUE HANDCYCLES:

Freedom Ryder: offers *lean-to-steer* models. These bikes offer a true bike feeling, leaning into turns like a conventional two-wheel bike. These bikes, however, can be unsteady, especially for beginning riders. They can work well for people who have some leg movement or are unable

to bend their knees (to accommodate turning the front wheel). They also work well for amputees.

The ***Hase Handcycle*** is a delta style trike with rear wheel drive. Rear wheel drive makes it possible to ride uphill on loose gravel without losing traction. It also has a swing-away boom that disconnects with a quick-release ball-and-socket joint attachment. This allows a user to get on and off the bike without having to slide their legs on either side of the wheel, easing the transfer. Many individuals that need a Hoyer lift for transfer do well on this style of handcycle. Unfortunately, the Hase requires custom pedal attachments with limited pedal options.

The ***Greenspeed Magnum Handcycle*** and ***Reactive Adaptations Nuke*** are tadpole style trikes. Transfers onto these bikes are cumbersome. With rear-wheel drive, they are considered a good off-road option, if equipped with the right tires. Design limitations include limited clearance and the width of the bike, as discussed in the Off-Road section.

HANDCYCLE WHEELCHAIR ATTACHMENTS

Handcycles are also available as wheelchair attachments. This can be a good option for someone who prefers to be in their chair rather than a dedicated handcycle, or for someone who is unable to transfer. This option is also much smaller and easy to transport. Many riders will use these attachments in busy places or where a regular handcycle may not be allowed. This is also a more affordable route to start cycling. However, this type of bike has limited use and is not designed for long rides. There are also versions of the attachment style bike allowing the use of an electric motor.

This handcycle attaches to the footrest down-tubes. It can be difficult to install, but after the initial setup it can usually be attached independently.

EXAMPLES: RIO MOBILITY DRAGONFLY, RIO MOBILITY FIREFLY (ELECTRIC)

HANDCYLE TANDEM SETUPS:

Tandem setups are often requested by riders looking for longer distance than they may be able to do independently.

AdaptiveWorld makes an aftermarket “Handcycle Coupler” that can be attached to the back of most handcycles; it allows a delta style recumbent foot trike to be attached. This setup is very popular in some programs, as it makes it possible for people with different abilities to assist each other. For example, a blind stoker in the back can collaborate with a weaker handcyclist in the front to do a ride that neither would be able to do alone.

Varna makes a tandem recumbent with the handcycle in the back. This model allows an able-bodied rider to captain the front of the bike, while the handcyclist acts as the stoker in back.

The Hase handcycle can be coupled as either the front or rear of a tandem, with either another Hase handcycle or a foot-powered delta recumbent bike. The universal coupler is attached to the back of the front bike and the second trike is attached at its front fork. With this system, the handcycle can be in either front or back; the tandem can also be ridden independently by separating the two bikes. Note: with this system, you can actually couple more than two bikes!

EXAMPLES: VARNA HYBRID TANDEM HANDCYCLE/CYCLE, HASE HANDCYCLE, HAND/FOOT TANDEM

HANDCYCLES

GRIP AND SHIFTING OPTIONS FOR HANDCYCLES

There are many accessories available for handcycles that allow users of varying abilities to maximize their potential on these bikes. The most common adaptation is the handgrips.

Standard grips — typically plastic or foam-covered — work well for people with full hand and finger function. Some of these grips also offer extensions to mount the gear and brakes, allowing the user to shift and brake without letting go of the handle (or cranks).

There are also grips made in various configurations to assist with grasp. Traditionally, these were tri-pins, which were bulky and awkward for the rider. V-grips gave some resistance, with a rubberized coating to create more friction and surface area to help hold hands onto the grip. "Quadgrips" offer a new spin on the tri-pin design, with an advanced shape to offer more comfort and independence.

A common complaint from handcyclists is pain or numbness in their hands when using conventional grips. Ergonomic grips that spread the pressure on the palm help to relieve this pain; they are available in many configurations for shift/brake levers.

For those with little to no finger function, glove modifications like the Bike-on.com C5 grips plug into receivers mounted onto the crank arms.

C5 Grip

Both Bike-on and Quad Grips offer program models that allow rapid interchanging of grips.

All of these grips allow a user to remove their hands independently, to brake, shift, or adjust. At no time should someone's hands be taped to the grips for safety reasons. Grips for each user should be the most comfortable, usable grip possible, and this may mean that a combination of grip styles will be used.

BRAKING AND SHIFTING FOR PEOPLE WITH LITTLE OR NO GRIP STRENGTH

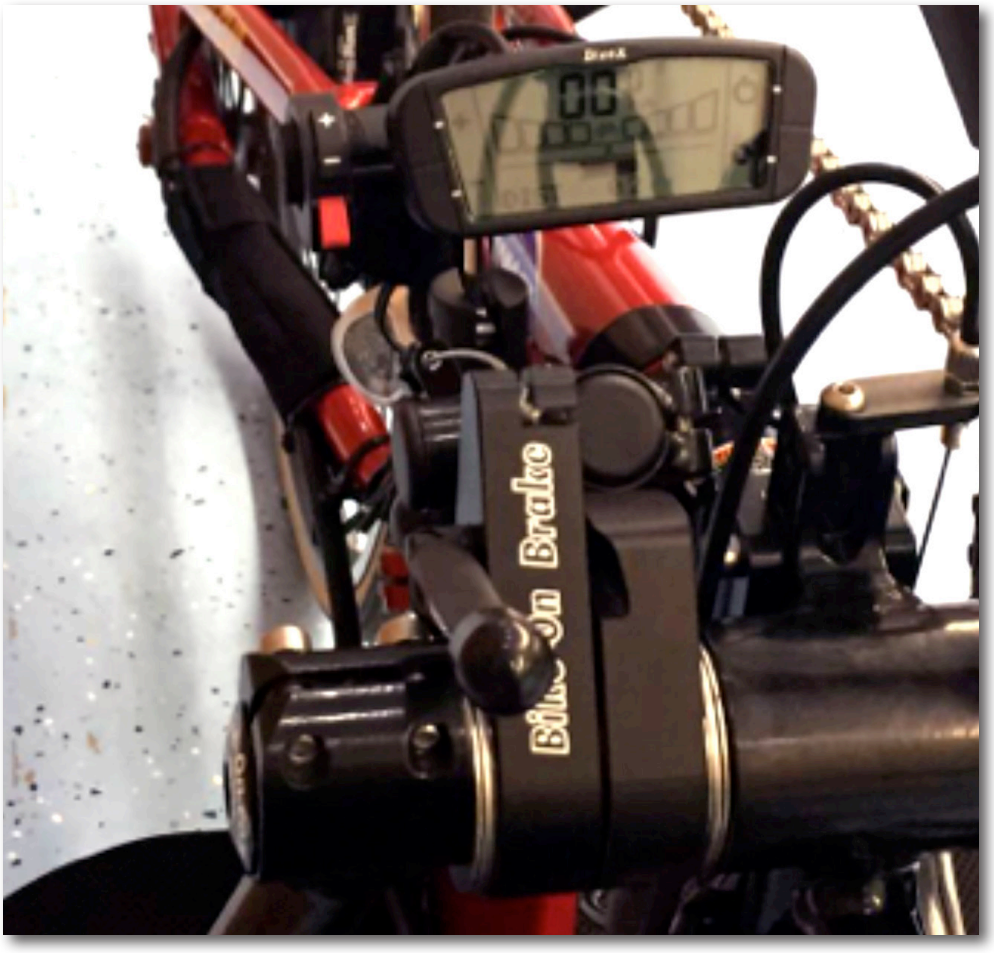
Many programs use handcycles with reverse braking systems. These are often combined with 7-speed internal gears, offering an affordable and easy-to-operate system for quadriplegics (quads). Riders do not need to remove their hands from the pedals to brake, and they can shift with one hand without much dexterity. Add-ons are available to twist shifters to make shifting easier. Drawbacks to these internal gear systems are that they are heavy, and one hand must be released in order to shift.

The Top End XCL and XLT are common handcycles that come standard with reverse brakes and can be enhanced with quad-friendly grips and shifter modifications.

QuadGrip

Recent advancements have made it possible for people with little or no hand function to ride higher performance bicycles as well. Although these bikes are low to the ground and transfers are more difficult, they offer much more trunk stability with a reclined position.

One of the biggest advancements for people with limited hand function is the Bike-on Brake. This ratcheting system allows the use of a freewheel drive system offering high-end performance with the security of reverse braking. This allows quads and other individuals with limited hand function to ride high performance bikes without the need for traditional brake levers. This can be coupled with Quad-Grips and electronic shifters or double tap shifters to allow many quads to train and enter races that were never before possible.



Bike-On Brake

OFF-ROAD CYCLES

OFF-ROAD CYCLES

The mountain biking/off-road cycling industry is experiencing a lot of expansion and diversification within the adaptive disciplines, as well as in general biking.

Adaptive off-road/mountain bikes allow a wide range of individuals to access rugged and rough terrain that would be inaccessible by handcycle or wheelchair: single-track trails, resort-based mountain bike parks, beaches, river crossings, and snow-covered terrain.

Incorporating off-road bikes into an adaptive cycling program requires some additional considerations with regard to facilitation, risk management, equipment, maintenance, and repair. This manual provides a brief overview and is not designed to be comprehensive.

In addition to the standard items for a road-based cycling program, off-road cycling requires the rider to have some knowledge of disc brake and suspension maintenance and repair. It also presents some unique risk management factors, such as greatly varying terrain, potential wilderness settings, and a much increased chance of rollovers and crashes.

Off-road handcycling options include: a tadpole/recumbent handcycle (e.g.., ReActive Adaptations Nuke); prone handcycle (ReActive Adaptations Bomber, One-Off, or Explorer 2); and off-road leg-powered recumbent (Ice, Stinger). Having all three of these styles available allows you to accommodate a wide range of populations.

Populations: Adaptive mountain bikes can accommodate nearly all the populations served by other areas of adaptive cycling. However, as the technical demands of the equipment and the terrain increase, greater independence is required for potential participants. Note that for children, there are few child-size off-road handcycles, recumbent bikes, or downhill 4-cross options. These are potentially available as a custom-build, however.

Off-Road Handcycles: Off-road handcycles can be divided into three categories: delta-style, tadpole upright (also referred to as recumbent upright), and tadpole prone.

Delta Style: off-road handcycles include models such as the Lasher All-Terrain Handcycle or Varna Big Wheels Handcycle. These models are similar to their on-road counterparts in regard to design, positioning, and adjustments, but they utilize the larger tires and other components of mountain bikes, such as disc brakes and suspension. As they are front-wheel drive, this style of off-road handcycle often experiences issues with lack of traction while climbing steeper grades. A steering mechanism controlled solely by the crank-arms also results in less responsiveness while negotiating technical terrain. This design can be ideal for long-distance rides or rides that may encounter a variety of terrain (paved to dirt road to mild single-track).

Tadpole Upright: (often referred to as recumbent upright) off-road handcycles include models such as the Nuke (by ReActive Adaptations) or the **Outrider Horizon**. This style of handcycle borrows advantages of comfortable positioning from the delta style cycles, combined with off-road design features of prone models such as rear-wheel drive and mountain-drives. These handcycles can serve a very wide range of participants and can be adapted to accommodate various impairments.

Unlike the delta style, the tadpole upright handcycle separates the crank arms from the steering arms and brake levers. The crank arms can be used to steer while pedaling, but the rider must transition from the cranks to the steering arms for more technical steering and to use the brakes. This positioning allows for greater control on technical descents, but the added complexity can be challenging for individuals with upper extremity impairments.

Standard adjustments for tadpole upright off-road handcycles include seat and back-rest angle as well as foot tray length. A rider should be positioned so that the crank arms comfortably clear the chest and stomach when closest to the rider, but keep a slight flex in the arms at the furthest point. Foot trays should allow for the rider's legs to rest comfortably with the soles of their shoes just touching the end of the tray.

Off-road handcycles can be adapted in numerous ways, such as repositioning brake levers and shifters to accommodate for impairments to grip strength, arm/hand amputations, or other impairments. The adaptive grips and pedals described above can also be utilized on these types

of handcycles. When adapting pedals/grips, ensure that the rider can use the braking system properly. Some custom pedals/grips incorporate a braking system into one of the crank pedals.

Tadpole prone off-road handcycles (such as the **ReActive Adaptations Bomber** and the **One-Off Flyer**) put the rider in a kneeling position; these bikes are designed for individuals with good core strength. This more aggressive position enables traveling over technical terrain while either pedaling or rolling downhill. Similar to the upright handcycles, the rider adopts a different position for pedaling than for rolling downhill. While pedaling, riders lay their chest on the steering platform, still allowing minor adjustments in direction while propelling themselves forward. While rolling downhill, riders push up and hold onto the handlebars to allow for more precision in steering as well as access to the brake levers.

Standard adjustments for these handcycles include: raising or lowering the steering platform; changing the angle of the steering platform; and moving the seat tray fore and aft. The height of the steering platform should be adjusted to enable the rider to keep a slight bend in the elbow when the pedal is at its lowest point. The seat should be positioned and steering platform angled to allow the center of a rider's chest to rest on the platform while pedaling.

There are limited adaptations available for these handcycles. Also, manufacturers often make custom builds that can accommodate various needs, such as for a rider with a leg amputation who needs a different position than the stock knee trays can provide.

EXAMPLES: REACTIVE ADAPTATIONS NUKE, REACTIVE ADAPTATIONS BOMBER, ONE-OFF FLYER, LASHER ALL-TERRAIN HANDCYCLE, EXPLORER 2

OFF-ROAD CYCLES

4-CROSS DOWNHILL BIKES

4-Cross downhill bikes are gravity-powered, high performance cycles designed to handle the demands of technical downhill specific trails. For those who also manage/facilitate adaptive ski programs, a good rule of thumb is that any client who is a candidate for sit-skiing, with hand-held outriggers, is potentially a good fit for a 4-cross adaptive downhill bike. This style of bike can be used by most individuals with good upper body and arm/hand strength.

These bikes are four-wheeled, full-suspension cycles that use traditional mountain bike handlebars and hydraulic disc brakes. (Some older, discontinued models utilized other steering designs and drum brakes.) These bikes put riders into a position similar to sit-ski, with a "bucket" to sit in and a tray for the feet to rest on. The rider sits in an athletic position, with flex in both elbows while grasping both grips of the handlebar, and with a comfortable reach even when turning completely in either direction.

4-Cross bikes are highly adaptable and can accommodate a very wide range of participants. Common adaptations include reversing brake levers to allow individuals with less grip strength to use their body weight to both steer and activate the brakes. Brake levers can also be repositioned in creative ways to accommodate impairments such as hemiplegia or amputations.

EXAMPLES: ACTIVE FORCE FOUNDATION SKYLINE QUADCYCLE, GROVE INNOVATIONS DH MOUNTAIN BIKE (OUT OF PRODUCTION)

Off-Road Recumbent Cycles: Off-road recumbents share many similarities to the road-specific versions, but with components and design specific for off-road use. Off-road recumbents will have lower gearing and fatter tires than traditional road models and may also incorporate suspension and disc brakes. Off-road recumbents are also designed with greater clearance, to avoid damage to components in rough terrain. Off-road recumbents can also be adapted in many similar ways to on-road versions: one-arm operation, adaptive pedals, crank arm shorteners, etc.

EXAMPLES: REACTIVE ADAPTATIONS STINGER, ICE ADVENTURE SERIES RECUMBENTS

Other/Hybrid/Custom Builds

Some common options available across multiple categories of adaptive off-road bikes include electric assist and fat tire builds.

Electric assist builds allow individuals with fatigue or strength impairments to travel farther or at higher speeds than otherwise. Note that some trails and off-road areas have restrictions on electric assist bikes.

Fat tire builds are available in upright, handcycle, and recumbent options; they allow for travel over snow, sand, and other soft surfaces.

Many manufacturers also offer custom builds to accommodate unique individual needs, such as combination arm- and leg-powered recumbents, child size frames, expedition quality builds, etc. Ask individual manufacturers for information about these options.

Off-Road Transfers

The transfer into delta-style and recumbent leg-powered off-road adaptive bikes is very similar, if not identical, to their road counterparts. Transfers into a tadpole upright (Nuke) or tadpole prone handcycle (One-Off) are unique, however, and often challenging for newer riders.

While transferring into a tadpole upright handcycle, a rider in a wheelchair should wheel their chair into the space between one of the front wheels and the seat of the handcycle. (Turning the wheels in the direction away from the rider will allow for more space to maneuver during the transfer.) The rider then positions one leg up and over the center tube of the frame. Then the rider transfers from the seat of the wheelchair to the seat of the handcycle, using the handlebar or any part of the seat for bracing. An individual may also use a transfer board to assist in this process. As the rider slides over to the seat of the bike, their foot slides into either the foot tray or the space between the seat and the foot tray. The rider can then position their legs into the foot trays. **Note – it is important to have the bike stabilized during this process, either with a parking brake or assistance by a trained staff or volunteer.**

Transferring into a tadpole prone handcycle can also be challenging for new riders. A riders in a wheelchair should position their chair into the space between one of the front

wheels and the seat and steering platform of the handcycle. The rider then raises their inside leg over the center tube of the frame, to straddle the vertical tube for the chest steering platform. The individual then transfers from their seat, positioning their butt into the seat of the handcycle and then leaning all the way forward to rest their chest on the steering platform. (Their feet are still in front of the knee trays, resting on the ground.) The seat and steering platform are ideal for the individual to brace against during the actual transfer. Then, with their weight divided between their butt on the seat and their chest on the steering platform, the rider should be able to use their arms to position their legs into the knee trays, one at a time.

Note – It is important to have the bike stabilized during this process, either with a parking brake or assistance by a trained staff or volunteer. This transfer process may take several attempts before someone can do it independently, and it often causes spasms for riders who are not used to being in this position. Having properly trained staff or volunteers to assist with the transfer will greatly ease the process. You may have to wait for spasms to cease before being able to bend an individual's leg into the knee tray.

For transfers into 4-Cross downhill bikes, the rider positions their wheelchair next to the rear wheel of the bike and uses the seat back and handlebars for support. The rider first positions their feet into the frame of the bike before transferring. Some may prefer to transfer from their wheelchair in two stages, first sitting on the rear wheel, then transferring into the "bucket." In this case, some padding on top of the wheel can help reduce any chance of injury from sitting on the wheel. Many riders may need assistance, up to a full-transfer with the assist of two staff/volunteers. **Note – it is important to have the bike stabilized during this process, either with a parking brake or assistance by a trained staff or volunteer.**

SAFETY CONSIDERATIONS FOR ALL HANDCYCLES AND TRIKES

SAFETY CONSIDERATIONS FOR ALL HANDCYCLES AND TRIKES

Safety Flags: Like many other adaptive bikes, handcycles and trikes are generally low to the ground. Safety flags should be used while riding on roads or in parking lots. These bikes sit lower than most car windows and can be especially dangerous in parking lots, when cars are maneuvering into or out of parking spaces.

Helmets: This is an obvious safety consideration, but some people still feel that they don't need a helmet due to the type of riding they do or because they dislike the appearance. You may be lower to the ground in a three-wheel, but accidents do happen — and your head should always be protected!

Leg Guards: Participants who ride handcycles often have some paralysis and/or limited sensation in their legs. Leg guards are a good preventative measure for the recumbent style bikes, to keep the legs away from the front wheel while turning. This can prevent significant burns from the friction of tire on skin.

Padding: For these riders with limited sensation, you also want to make sure there are no other spots where their legs or hips are contacting metal or moving parts, creating pressure below their level of sensation. Any contact points should be padded, or another bike should be sought, to lessen the chance of a pressure sore. It often works better to pad the person rather than the bike as body parts may shift position while riding. Soccer, hockey, or mountain biking body pads and armor are a great option for protecting a client's body when cycling, and they can often be found used at thrift stores.

Additional Safety Concerns: Any means of securing a person to the bike can have safety implications, including safety belts, click straps, ankle straps, feet or hands duct taped. All of these options are typically used to help an individual stay in a seat, to stop their legs from bouncing off a footrest, or to provide extra support. They should be used if the rider needs or prefers this level of security. If the rider does not need these types of restraints, leave them off. It is often safer to separate from the bike in the event of a crash, and being tied to the equipment can cause additional injury. If the rider's ankle is strapped in, for example, and they tip the bike, if the Velcro doesn't break free this could cause serious injury to their ankle or leg. If support is not needed, do not use straps; if it is needed, be aware and inform your participants of the risk.

Some handcycles are equipped with a return-to-center road crown compensator. This is designed to keep the steering centered while pedaling and to allow for some resistance when steering, using springs and a threaded connection. The compensator allows for adjustment to road crown or the sloping of the road. Since handcycles (like all three-wheeled vehicles) tend to track downhill, a twist or two of the compensator will turn the steering into the crown of the road, resulting in a straight track. As road crown changes, the compensator can be adjusted again from the rider's position.

Other bikes also have some type of steering resistance, including rubber elastomers. Without these components, steering would be very loose and would rotate effortlessly. This is not a good scenario if you are powering the bike from the handles as well as controlling steering. The compensator or elastomer will keep the front end of the bike straight, so effort can be concentrated into steering and power.

EQUIPMENT AVAILABILITY

EQUIPMENT AVAILABILITY

Equipment can often be the determining factor in a program's success, and it determines how many participants can be involved in a program.

To get most people riding successfully, you need a core group of about six bikes:

- **3 handcycles: upright, base recumbent, and advanced recumbent**
- **2 foot-powered recumbents: delta and tadpole trikes**
- **1 youth-sized assisted riding trike**

With this assortment, almost all disabilities can be provided for.

The next bike to add would be a tandem or an additional delta foot-powered trike, giving you the ability to ride tandem with a participant with visual impairment or a cognitive disability requiring assistance.

From here, you can keep adding the bikes that are used often, based on the needs of the population you serve. Advanced recreational handcycles and recumbent foot-powered bikes are very popular and serve a wide range of participants. You can also start adding other "unique" or less common bikes to fill a specific niche within your program. And don't forget the kids' bikes: one of each style for kids or short adults is great! Before long, you will have 20 or 30 bikes or more in your program and will be able to properly select the best bike for each participant you serve.

Providers: There are many providers for this equipment. Some may even work out a deal with a program buying multiple bikes, either at one time or as repeat customers. Many internet sites offer free shipping, but this typically does not include bikes. The bikes usually ship direct and mostly assembled, so shipping can be expensive. Be prepared when you go to purchase; consult an experienced person about the bike you are looking for. Most order forms are online, so you can see what options are available. If you can't talk with the providers or they don't seem knowledgeable, go someone else. There are some really good providers that, even if not in your backyard, will be glad to work with you to get the bike that will work best for your participants.

As with most adaptive equipment, many of these bikes are custom-made. Plan for your program's clients and what will work for most of them. As you start to get duplicates, you may increase the selection of options and sizes.

Funding Sources: There are many options for funding sources. Everything from local foundations to large grants have been used to get programs started or to supplement a fleet. Look around and ask among your contacts to get an "in" with a local civic organization or philanthropic group. Groups like to fund equipment because they can see what they are buying. You can then go back to them and show pictures, show the equipment itself, and report the number of people who became involved because of their involvement.

Participants also have the opportunity for grant funding to get a personal bike. Participants will ask about equipment funding, so you want to know about some of the local and national sources to refer people to.

Equipment Conclusion: Although these are the most typical styles of bikes, many inventors have come up with other bikes to fulfill a need that they have encountered. Once you start looking around, the design of bikes will seem to be endless. Various components are used to maximize the potential of the bikes, to make them safer, or to prepare them for specific areas or terrain.

There is an endless supply of adjustments and components possible to any of the bikes, to make shifting, braking, or anything else work better for your participants. Build on the frame and add as needed for each rider, to give them the best opportunity possible.

COMMON DISABILITY TYPES AND RECOMMENDATIONS

The only thing bigger than the selection of bikes available is the range of abilities that you may see in a cycling program. Bikes are made in all different styles, allowing riders of all abilities to get out and feel the breeze in their face.

The following is a partial list of disabilities, with recommendations for what may best suit riders. Bear in mind that individuals with the same disability may present very differently. The disability may be significant in one person but limited in another, or limited at a certain time of day, or dependent on the weather, and on and on.

Talk with each individual and discuss the options. No one will know how a disability affects a person better than that individual. If more information about a disability is needed, it is advisable to research the diagnosis to learn the precautions you may need to address while working with this individual.

Many people, especially in the beginning phases of cycling, will require assistance to some degree. Getting on and off the bikes is the hardest part for many. Ask your participant about the best way for them to transfer. You can either build a relationship here or break the trust, depending on how you handle this. Include the person in the decisions and talk through beforehand how you will proceed. Work together to make the activity as smooth as possible and build your program's reputation.

PHYSICAL DISABILITIES

Leg Amputation: A single foot or leg amputation, below the knee (BKA), can offer many cycling options. Many of these riders will prefer to ride a two-wheel bike with a prosthetic; others may prefer to reduce anxiety by riding a trike. There is still some musculature around the knee, and flexion and extension of the prosthetic is possible, allowing them to pedal. Above the knee amputations (AKA) change this a bit. Because of the loss of the knee joint, it is difficult to get much power from the affected side. It is also difficult for a prosthetic to articulate at the knee. Many riders will forgo their prosthetic and ride with one leg; a pedal cage or clip-less shoe will assist with this. There is no limitation with the use of a handcycle and this is the best choice for double amputations.

Arm Amputation: An arm amputation (either below the elbow, BEA, or above the elbow, AEA) can make things a bit harder, especially on two-wheeled bikes. Steering and weight bearing is difficult with one arm (especially on mountain or road bikes). If a two-wheeler is sought, a hybrid bike or one with a more upright seating position is a good choice. A trike may be the best option here, as the seating position allows the rider to use both legs; the bike can be set up for one-arm control for steering, shifting, and braking.

Brain Injury (BI), Stroke (CVA): A brain injury of any kind can result in many types of physical and/or cognitive limitations. Many people with BIs lose some coordination but still have some strength, on one side (hemiparesis) or both sides. The recumbent trikes generally work well for this group, compensating for loss of balance.

The most usual modifications are pedals with toe and heel loops to secure feet, and controls on one or both sides. If the participant has some cognitive deficits, special care should be given to safety; a recumbent tandem or traditional tandem may be a better option.

If the person has had a stroke, the leg on the affected side may be inflexible and difficult to get on the pedal. Stretching before a ride can help, as well as modifications to secure their feet. Their strong side can compensate for their weak side: the bike can be set up with all the controls on one side.

Cerebral Palsy (CP): Cerebral palsy is caused by injuries or abnormalities of the brain. While most of these problems occur before or during birth, they can happen at any time during the first two years of life while the brain is still developing. Symptoms range from very mild to severe, affecting speech, muscles, joints, cognitive ability, and more.

Participants with CP can vary greatly in ability, and bike choice generally depends on leg strength. Many riders do well on hand-powered bikes while others prefer leg-powered.

Spasticity is an important consideration to address with participants, as it can result in feet (or arms) coming off pedals while riding. Extra care should be given to make

sure a rider is safe and will not lose control while riding. This can also affect use of handcycles; if spasticity is an issue, a foot-powered bike may be a better choice, with the rider's feet secured. If this is not possible, try different models of handcycles to determine the best and safest bike for your participant.

Spinal Cord Injury (SCI): Spinal cord trauma — damage to the spinal cord — may result either from direct injury to the cord itself or indirectly, from damage to surrounding bones, tissues, or blood vessels. Generally the impairment will be from the level of injury down. Individuals with SCIs generally do better on handcycles, due to the impairment of the lower limbs. Hand modifications work well for C5-6 quadriplegia, or others with limited grip. Individuals with an injury higher than C5 will have difficulty powering a bike on their own due to limited arm strength. For them, a bike like the Duet tandem may be the best option.

Paraplegia: Complete or incomplete injury in the thoracic or lumbar vertebrae (mid-chest down to base of spinal cord). This results in the loss of ability and/or sensation in the lower torso and limbs.

Quadriplegia: Complete or incomplete injury in the cervical vertebrae (neck area), leading to the loss of ability and/or sensation in all four limbs and middle of the body.

Autonomic Dysreflexia: This is a reaction of the autonomic (involuntary) nervous system to overstimulation that may occur with an SCI above level T5. Symptoms may include: high blood pressure, change in heart rate, skin color changes (paleness, redness, blue-grey skin color), and excessive sweating. This condition can be potentially life threatening! Research more so you know the symptoms and can react promptly and appropriately.

Spina Bifida (SB): Spina Bifida is a birth defect in which the backbone and spinal canal did not close before birth, resulting in an incomplete cord and limited ability below this point. Participants with SB generally have strong upper bodies and do well on handcycles.

Note: Individuals with SB often have latex allergies, so special care should be given to grip selection, and caution is needed around tires.

Multiple Sclerosis (MS): Multiple Sclerosis is caused by damage to the myelin sheath, the protective covering that surrounds nerve cells. When this nerve covering is damaged, nerve impulses are slowed down or stopped. Individuals with MS present with varying ranges of ability. Cool weather is best, as individuals fatigue quickly in warm weather. Care should be given to the setting of events that will include a sizable MS population. An indoor controlled-climate setting may be the best choice.

Recommended cycles vary depending on ability, using hand- or leg-powered bikes.

Note: Two-wheeled bikes may be a dangerous choice, as people with MS are subject to fatigue.

Visual Impairment (VI): Visually impaired riders generally will need some guidance while riding, depending on the level of their vision. Many VI cyclists will ride two-wheeled tandem bikes, with a friend, family member, or volunteer acting as a guide. The VI rider will generally be in the stoker position, while the captain is in control. (Guiding on a tandem is easier than in skiing, as the guide is in full control of steering.) VI riders do well on this style bike, and some ride recreationally all the way to competitive levels and Paralympics.

Depending on their level of vision, cyclists with VI can ride many types of bikes on their own, with proper direction by a trained guide and in a safe location. The delta trike tandem setup, described in the tandem section, is a great way to assist a VI recreational rider. They can ride either in the stoker position behind or in the front bike, guided by a sighted rider in back. The back rider (guide) has their own set of controls and the ability to stop the tandem, but they cannot make a turn from the back position, so the environment needs to be considered carefully. This is a very empowering experience for the VI rider, to be in control of the tandem.

COMMON DISABILITY TYPES AND RECOMMENDATIONS

Developmental/Cognitive Disabilities: Many programs have riders with developmental disabilities. These diagnoses include the autism spectrum, Down syndrome, learning disabilities, and others.

Single-speed bikes and coaster-brake three-wheel bikes work well for these participants. Two-wheel bikes can be ridden with some practice, or with training wheels, but three-wheel trikes offer quick success and lessen frustration for these riders.

If a participant is interested in learning to ride a two-wheel bike, start them off scooter-style — with no pedals, sitting on a lowered seat, walking their feet along the ground. Build an individual program according to the ability of the rider.

EVENT MANAGEMENT

CLINICS

The best way for people to try out bikes is through an adaptive cycling clinic.

Of course, participants may also come through your door one by one, but a clinic gives them a great opportunity to see and try out many bikes, all in one place, at one time. Clinics also create an opportunity for participants to talk with others with similar interests. Seeing everyone trying bikes creates excitement as well as learning from others' experiences.

The goal for this event will vary, depending on the participant. For some, it may be the first time to see whether this is a sport they will enjoy. For others, it's the chance to learn everything they can and decide on a bike they might purchase. For you, this is your chance to build an educated consumer. Remember, first experiences are very powerful. If your participant tries cycling and falls in love with it, you will have an active new participant! If the experience is not positive, you may lose them from cycling and potentially other activities and programs.

On occasion, someone may be struggling with the equipment or with their own ability level. Work closely with them and help them find solutions. Bring others in to help problem solve and suggest tips, tricks, or even exercises that can lead to future success.

Basics: To start a cycling clinic, you need to build an assortment of equipment and trained staff or volunteers (hopefully both), and find a good location. An indoor facility (such as an indoor track) is ideal for protection from the weather — sun, rain, or snow. It also keeps everything within a contained space, so you can see everything that is going on and keep track of bikes' availability, in a safe environment that is close to bathroom facilities.

If an indoor facility is not available, try to find a location with some of these attributes: level terrain, paved trails, and some type of shelter, possibly with some type of bathroom facility as well. On weekends, an office park can offer minimal traffic, large parking lots that can be used as a test area, and in some cases access to bathroom facilities. There are many disability-related organizations around the country that may be willing to help with this. Often they are in a good setting, have access to volunteers, and have accessible facilities.

Participant Scheduling: Pre-registration is essential. Decide how many instructors are going to be available, and plan for no more than two participants per instructor per hour. An hour-long block is generally enough to introduce a rider to the sport and make necessary adjustments. A rider who wants to really get the feel for the bike may stay longer, but their instruction will be less intensive. This ratio of 1:2 gives each participant a good amount of attention.

EVENT MANAGEMENT

The limiting factor for these events is usually equipment. More often than not, everyone will want the same equipment at the same time. Try to get as much information as possible during pre-registration so you can schedule people that may use similar bikes at different times. This will help keep things moving throughout the day.

Plan for the Unexpected: Ask a volunteer who knows bikes well to act as your mechanic; they can help get broken bikes rolling again quickly. A good assortment of bike tools is essential.

Have a large selection of bike helmets and bike flags available for safety. All riders should be required to wear a helmet when on any of the bikes.

You should be prepared for any incidents. An EMT volunteer can easily be found by asking at the local fire station or a school that offers an EMT course.

Release waivers should be signed during registration.

Helpful accessories to have on hand include: neoprene athletic straps, Velcro straps, tire tubing, duct tape, foam, etc. *Be prepared!*

Group Rides: Cycling rides can bring groups of people together for fun and exercise.

Choose a route that suits the group's ability. During the registration process, make sure that information is conveyed about the level of difficulty of the route, including hills or rough sections. Include alternate routes, maybe with shorter distances. A rating system of 1–4 (beginner to advanced level) can helpful.

Route selection can be on- or off-road, but keep in mind the terrain, the participants, and the bikes they will be riding. The goal for your rides should be an introduction to cycling and group riding, an opportunity for riders to participate with others with like interests. It is important to accommodate entry-level riders by keeping the level of risk down.
Rail trails are a great option, with relatively easy grades and minimal traffic. Riders can go long distances, only contending with road crossings and other trail users.

Road Riding: can be more dangerous. Seek out roads with wide shoulders and less traffic if possible. Also, keep in mind the terrain of the roads you ride. Hills may seem manageable, but assisting a rider up a hill on a busy road puts you in the path of general traffic — and, unfortunately, not everyone is cautious of cyclists. An easier route may reduce the risks and make the ride more manageable for more people.

Safety Planning: varies depending on the route, skill of the riders involved, and numbers of riders.

- **All riders should wear helmets.**
- **Have safety flags on any of the hand or foot-powered trikes.**
- **Riders should be prepared with appropriate clothing, water and snacks.**
- **Basic tools and extra water should be available, as well as a first aid kit and cell phone in case of emergency.**
- **An experienced rider/guide should carry additional tools to help with any mechanical issues.**

Volunteers should be used to monitor riders and help out where needed. One volunteer or staff member should lead, and another should sweep the end of the group, with other support riders scattered in between. If a rider has to turn back, it is good to have an extra assistant you can send back with them, should they need a hand.

Group rides can be difficult to manage, as most groups usually spread out quickly. Be prepared: be familiar with the route, and have good communication with volunteers. Provide maps, if you feel riders may get lost.

The last person on the road should be the sweep rider (staff or volunteer) at the back of the group.

EQUIPMENT PICTURES

DELTA TRIKES

HASE KETTWIESEL

(Lepus is similar, with rear suspension)

HASE TRETS
(KID'S TRIKE)

DELTA TRIKES

GREENSPEED ANURA

DELTA TRIKES

DELTA TRIKES

SUN X3 AX

TADPOLE TRIKES

GREENSPEED GT SERIES

(GT1, GT3, GT5 with Drum Brakes)

GREENSPEED MAGNUM

TADPOLE TRIKES

(adjustable seat height/recline) Folded

EQUIPMENT PICTURES

TADPOLE TRIKES

CAT TRIKE

TADPOLE TRIKES

TERRA TRIKE

SCHWINN VOYAGEUR

TANDEMS

TANDEMS

HASE PINO

TANDEMS

KETTWIESEL

with Tandem Coupling

GREENSPEED GTT

TANDEMS

EQUIPMENT PICTURES

TANDEMS

FRANK MOBILITY DUET

VARNA HYBRID TANDEM HANDCYCLE/CYCLE

TANDEMS

AMTRYKE

THERAPEUTIC TRIKES

THERAPEUTIC TRIKES

FREEDOM CONCEPTS DCP16

THERAPEUTIC TRIKES

RIFTON

TOP END EXCELERATOR

HANDCYCLES

EQUIPMENT PICTURES

HANDCYCLES

HANDY UPRIGHT HANDCYCLE

HANDCYCLES

TOP END XLT

QUICKIE SHARK

HANDCYCLES

HANDCYCLES

TOP END FORCE 3

HANDCYCLES

TOP END FORCE G

GREENSPEED MAGNUM HANDCYCLE

HANDCYCLES

EQUIPMENT PICTURES

HANDCYCLES

HASE HANDBIKE

HANDCYCLES

FORCE RX

CARBON BIKE

HANDCYCLES

VARNA LIBERATOR BIG WHEELS

HANDCYCLES

LASHER SPORT ATH

HANDCYCLES

REACTIVE ADAPTATIONS BOMBER

HANDCYCLES

EQUIPMENT PICTURES

HANDCYCLES

ICE FULL FAT

RIO MOBILITY DRAGONFLY (ATTACHMENT)

HANDCYCLES

BIKE-ON.COM C5 HANDGRIPS

CYCLING ACCESSORIES

CYCLING ACCESSORIES

QUADGRIPS.COM

CYCLING ACCESSORIES

BIKE-ON ERGO LITE GRIPS

TOP END FOAM COVERED ERGONOMIC HANDGRIPS

CYCLING ACCESSORIES

EQUIPMENT PICTURES

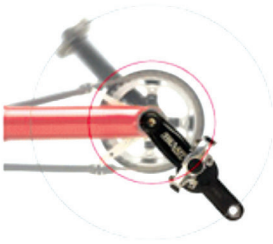
CYCLING ACCESSORIES

TOP END HORIZONTAL HANDGRIPS

Pedal with Calf Support

Adjustable Platform Pedals

Pedals with Hook and heel loop



Crank Arm Shortener

with your pedals

Pedal Pendulum with

Crank Arm Shortener

to lessen leg extension

on affected side

CYCLING ACCESSORIES

HASE PEDAL OPTIONS

BIKE-ON AND GOHANDCYCLE RACK

CYCLING ACCESSORIES

APPENDIX 1. PARA-CYCLING

Para-cycling is the official term for the competitive aspect of adaptive cycling and has been included at the Paralympic Games since 1992.

INTERNATIONAL GOVERNANCE

In 2007, the Union Cycliste International (UCI) officially took over the governance of Para-cycling from the International Paralympic Committee (IPC).

Major International Competitions:

The UCI sanctions five types of international competitions:

- Paralympic Games (road and track, since 1992)
- World Championships (road and track, since 1994)
- Road World Cups (since 2010)
- C1 Events (road or track)
- ParaPan American Games (road and track)

Events:
Para-cycling competition consists of the following eight events.

Road:

- Road Race (men and women)
- Individual Time Trial (men and women)
- Handcycle Relay (mixed)

Track (Velodrome):

- Tandem Sprint (men, included at the World Championships but not at the 2016 Paralympic Games)
- Team Sprint (mixed)
- 500m Time Trial (women)
- 1 kilometer Time Trial (men)
- Individual Pursuit (men and women)

Classification and Equipment: The UCI administers a functional classification system for men and women. The minimum racing age to compete at the World Championships and Paralympics Games is 18.

Para-cycling includes four major impairment groups as follows:

1. Blind and Visually Impaired Riders (tandems with a sighted pilot, men and women): Classes B
2. Locomotor Disabilities (standard 2-wheeled bicycles with or without adaptations, for men and women with single or multiple limb impairments): Classes C1 – C5
3. Cerebral Palsy (3-wheeled, upright trikes, for men and women with cerebral palsy or similar functional impairment): Classes T1 – T2
4. Handcycling (3-wheeled recumbent or kneeling hand cycle for men and women with lower-mobility impairments): Classes H1 – H5

DOMESTIC GOVERNANCE

U.S. Paralympics Cycling, part of the Paralympic Division at the United States Olympic Committee, manages the national program for Para-cycling in the United States and manages high performance, emerging, and talent identification programs, including the National Team and Team USA rosters for participation at UCI-sanctioned international competitions.

U.S. Paralympics Cycling also works closely with USA Cycling to provide training for certified coaches as well as for event organizers, in order to integrate Para-cycling in to domestic training programs, teams, and competitions.

Domestic Coaching: A Para-cycling coaching module and training, conducted by U.S. Paralympics Cycling, is now available for licensed USA Cycling coaches. More information about coaching can be obtained from USA Cycling: www.usacycling.org

Domestic Events: USA Cycling and U.S. Paralympics cycling collaborate annually to conduct the National Championships, and more domestic events include specific races for Para-cyclists each year. A Para-cycling module and training for race directors, conducted by U.S. Paralympics Cycling, is now available for certified USA Cycling race directors. More information about the race director certification program, as well as an event calendar can be obtained from USA Cycling: **www.usacycling.org**

Athlete & Sport Program Plan: U.S. Paralympics Cycling publishes an annual Athlete & Sport Program Plan, which is a "road map" for cyclists who aspire to make the U.S. Paralympic Cycling Team, or compete internationally for Team USA. The Plan provides detail about national team benefits, annual schedule, and criteria for national team status.

In addition, U.S. Paralympics also publishes selection procedures for Team USA participation at UCI World Cups, World Championships, the Parapan American Games, and the Paralympic Games.

FOR MORE INFORMATION ABOUT PARA-CYCLING, PLEASE VISIT THE FOLLOWING RESOURCES:

http://www.usparalympics.org/cycling • http://www.uci.ch

APPENDIX 2. EVENT PLANNING - RESOURCE, SAFETY, SITE PLAN

Activity/Event:_____

_____ Date:_____

Designated NEP STAFF: _____

_____SUPPORT:_____

Total number of participants to be served:_____

(determined by discussion of available resources between instructor and program coordinator. Target 10-20)

Total number of volunteers:_____

Site Equipment	Develop Postcard Identify Instructors/Staff Media/Marketing Plan	Mailing Distributed	Develop Info packet Revisit site Submit additional insurance	Info packet Distributed	Confirm site/ vol/equip Submit Press Release	Calls	Activity Event	Evaluation Stats Thank Yous				
12 wks	11 wks	10 wks	9wks	8wks	7wks	6wks	5wks	4wks	3 wks	2wks	1 wk	1 wk

EVENT SITE/LOCATION:

_____

Primary Site: _____

_____

Address: _____

City/State/Zip: _____

Site Phone: _____

Contact: _____

Contact Phone: _____

Email: _____

Emergency Service: _____

_____

_____

Contact: _____

_____

❑ Confirmed Date: _____

❑ Additional Insurance required: Y ❑ N ❑

❑ Cost: $ _____ Due date (with receipt)

❑ Directions received.

ACCESSIBLE RESOURCES	MODIFICATIONS NEEDED
❑ Parking	❑ Ramps
❑ Entrance	❑ Portable toilet
❑ Restroom	❑ Snow fence
❑ Activity	❑ Area Other_____
❑ Lodging	_____
❑ Other_____	

Notes: _____

_____

_____

_____

EVENT PLANNING - RESOURCE, SAFETY, SITE PLAN

EVENT SITE/LOCATION:

_____

Secondary Site: _____

_____

Address: _____

City/State/Zip: _____

Site Phone: _____

Contact: _____

Contact Phone: _____

Email: _____

Emergency Service: _____

_____

_____

Contact: _____

_____

❑ Confirmed Date: _____

❑ Additional Insurance required: Y ❑ N ❑

❑ Cost: $ _____ Due date (with receipt)

❑ Directions received.

ACCESSIBLE RESOURCES	MODIFICATIONS NEEDED
❑ Parking	❑ Ramps
❑ Entrance	❑ Portable toilet
❑ Restroom	❑ Snow fence
❑ Activity	❑ Area Other_____
❑ Lodging	_____
❑ Other_____	

Notes: _____

CANCELLATION PLAN:
In the event this program must be rescheduled or cancelled due to low registration, inclement weather, or other considerations, the following plan will be enacted.

❑ Rescheduled

Date to reschedule event ___/__ /___

❑ Cancelled

Refunds Distributed ___/__ /___

❑ Communication will be disseminated via:

❑ Email ❑ Phone ❑ Mail

Before ___:___ AM PM

On ___/__ /___

Please refer to NEP Policies & Procedures for details.

INSTRUCTORS:

Name: _____
Organization: _____
Address: _____
City/State/Zip_____
Day Phone: _____
Evening Phone: _____
Email: _____

❑ Confirmed Date:_____
❑ Additional Insurance required: Y ❑ N ❑
❑ Cost: $_____ Due date(with receipt)_____
❑ SSN (if payment is due) _____-____-_____

_____

_____

INSTRUCTORS:

Name: _____
Organization: _____
Address: _____
City/State/Zip: _____
Day Phone: _____
Evening Phone: _____
Email: _____

❑ Confirmed Date: _____
❑ Additional Insurance required: Y ❑ N ❑
❑ Cost: $_____ Due date(with receipt) _____
❑ SSN (if payment is due) _____-____-_____

_____

_____

PARTNERING ORGANIZATION: _____ Contact: _____

ROLE: _____ Phone: _____

_____ Email: _____

EVENT PLANNING - RESOURCE, SAFETY, SITE PLAN

EQUIPMENT

EQUIPMENT REQUIRED:	SUPPLIED BY:	CONTACT:	CONFIRMED:
❑ First Aid Kit ❑ Toolbox	❑ Northeast Passage ❑ _____		❑ ___/__ /___
	❑ Northeast Passage ❑ _____		❑ ___/__ /___
	❑ Northeast Passage ❑ _____		❑ ___/__ /___

CONFIRMATION CALLS

❑ SITE ❑ INSTRUCTOR ❑ EQUIPMENT ❑ VOLUNTEERS ❑ PARTICIPANTS

WRITTEN CORRESPONDENCE

PARTICIPANT	VOLUNTEER	INSTRUCTOR	MEDIA	THANK YOUS
❑ INFO PROVIDED • Date/Time • Cost • Directions • Attire • Personal Equipment ❑ Physical/ Release Forms	❑ INFO PROVIDED • Date/Time • Cost • Directions • Attire • Personal Equipment ❑ Physical/ Release Forms	❑ INFO PROVIDED • Date/Time • Cost • Directions • Attire • Personal Equipment ❑ Physical/ Release Forms	❑ Press Release Sent ___/__ /___ ❑ Articles Written to:	❑ Instructors NA ❑ ❑ Volunteers NA ❑ ❑ Site NA ❑ ❑ Participants NA ❑

BIKE RIDE SIGNUP LIST

QUANTITY	MFR.	MODEL	COLOR	RIDER
1	Buddybike	Tandem	Maroon	
1	Hase	Kettwiesel	Grey	
1	Hase	Trets Trike	Red	
1	Hase	Pino	Red	
1	Quickie	Shark	Silver	
1	Top End	Force	Black	
1	Top End	Force G	Blue	
1	Top End	XLT Pro	Yellow	
1	Trailmate	Banana Peel	Black	
1	Trailmate	Joyrider	Blue	
1	Frank mobility	Duet	Red	
1	Greenspeed	GTC	Blue	
1	Greenspeed	GTO	Red	
1	Greenspeed	GTO	Red	
1	Haverich	2 Wheels	Yellow	
1	One Off Ti	Mountain	black - Blue	
1	Quickie	Mach Jr	Yellow	
1	Quickie	Shark S	Forest	
1	Top End	Lil' Excelerator	Orange	
1	Top End	Excelerator	Forest	
1	Top End	Excelerator c MD	Red	
1	Top End	XLT c MD	Silver	
1	Top End	XLT Jr	Red	
1	Top End	XLT Jr	Blue	
1	Top End	XLT Pro	blue	
1	Top End	XLT Pro	Purple	
1	Trailmate	DeSoto Classic	Red	
1	Trailmate	Funcycle	Blk/Yellow	
1	Trailmate	Low rider	Silver	
1	Hase	Kettwiesel handcycle	Red	
1	Hase	Kettwiesel	Red	

CYCLING PACKING LIST

- ❑ EVENT SIGN-UP SHEET
- ❑ EVENT BOOK
- ❑ PHYSICAL/RELEASE/FITTING/ INCIDENT FORMS
- ❑ HELMETS
- ❑ FLAGS
- ❑ HAND/FOOT MODS
- ❑ AIR PUMP
- ❑ TIRE TUBING
- ❑ CYCLING TOOLBOX
- ❑ CUSHIONS
- ❑ TAPE
- ❑ STRAPS
- ❑ WATER
- ❑ FIRST AID KIT
- ❑ EXTRA TUBES/ PATCH KITS
- ❑ BANNER & MATERIALS TO DISPLAY IF NECESSARY
- ❑ RADIOS
- ❑ SUNSCREEN/INSECT REPELLENT
- ❑ CAMERA
- ❑ EZPASS
- ❑ SHADE TENT

CYCLING FITTING FORM

Rider: _____ Date: _____

Disability: _____

_____

Height: _____ Weight:_____ Helmet size: _____

CYCLE: _____ **Color:** _____

Brakes: Foot ❑ Hand ❑ Left ❑ Right ❑

Hand Modifications: _____

Grips:

Right: Vertical ❑ Ergonomic ❑ Quad Cuff ❑ Horizontal ❑ C5 ❑

Left: Vertical ❑ Ergonomic ❑ Quad Cuff ❑ Horizontal ❑ C5 ❑

Other, please specify: _____

Foot Modifications: _____

Footrest Position: Right: _____ Left: _____

Seat Position: _____

Boom Length: (if applicable) _____

Foam/Cushions: _____

_____

Transfer: Independent ❑ Assisted: Min ❑ Mod ❑ Max ❑

Biking Level: Beginner ❑ Intermediate ❑ Advanced ❑

Notes: _____

_____

Recommendations:_____

_____

Event: _____ **Form Completed by:** _____

ADAPTIVE CYCLING WORKSHOP:

Scenario 1: James is a 48-year old male who has been living with Multiple Sclerosis for a number of years. He uses a manual wheelchair for mobility, and is able to transfer independently unless fatigued, in which case he prefers to have minimal assistance. Staying active helps ease his chronic pain so he is looking to start cycling. There is a rail trail that runs very near his house that he plans to ride the one mile route to town and back several times a week.

What cycling equipment would you recommend for James and why?

Scenario 2: Mike is a 33-year old male who has a T-4 complete spinal cord injury (SCI). Prior to his injury two years ago, Mike was an active cyclist who enjoyed participating in local and regional cycling rides, and is looking to get back on the road. He uses a manual wheelchair for mobility and is able to transfer independently.

What cycling equipment would you recommend for Mike and why?

Scenario 3: Cheryl is a 59-year old female who experienced a stroke (CVA) two years ago. As a result she experiences hemiplegia on her left side and struggles with expressive aphasia. She has not ridden a cycle since her stroke, but owns a road bike that she no longer feels comfortable riding.

What cycling equipment would you recommend for Cheryl and why?

Scenario 4: Jennifer is a 22-year old female who acquired a brain injury four years ago. As a result, she experiences impaired balance, delayed processing, and is impulsive. Her caregivers are concerned about her judgment if she were to ride on the road, therefore, they intend to ride together in parks and on bike trails.

What cycling equipment would you recommend for Jennifer and why?

GLOSSARY

Bar End Shift – A mechanism mounted on the end of the handlebar that, when moved forward or back, activates the shifting mechanism.

Boom – Part of the frame on a foot-powered trike (tricycle), extending from the mainframe out to the cranks (and on a delta trike, also to the front wheel).

Cable Doubler – Splits a brake cable from one cable (coming from the brake lever) to two cables going to two individual brakes.

Chain Gobbler – A chain tensioning system that allows the length of cranks to be adjusted without changing the length of chain

Delta Trike – A trike with one wheel in front and two wheels in back.

Derailleur – A shifting mechanism, either at the rear wheel (rear derailleur) or at the crank (front derailleur). This mechanism moves when the shifters tighten or loosen the cable, allowing the chain to shift onto an easier or harder gear.

Double Pull Brake Lever – A brake lever that accepts two brake cables that each activate both brakes.

Grip Shift – A mechanism on the grip that, when turned, activates the shifting mechanism.

Handcycle – A trike that is powered by hand pedals rather than foot pedals.

Kingpins – On a tadpole recumbent, the point where the front wheels are turned.

Mountain Drive – A two-speed gear system within the crank housing (bottom bracket) that switches between low and high gear with a touch of the button on either side.

Pilot or Captain – The driver on a tandem cycle (typically the front rider on a traditional tandem).

Prone – An extremely reclined position, lying back in the seat.

Recumbent – The rider's reclining position in a trike; any cycle that allows the rider to sit leaning back.

Road Crown Compensator (RCC) – An adjustable spring mechanism that automatically adjusts the steering to account for drifting to the right at the road crown (often on a delta style handcycle).

Stoker – The second rider on a tandem cycle who pedals but is not in control of the cycle (typically the rear rider on a traditional tandem).

Tadpole – A trike with two wheels in front and one wheel in back.

Trigger Shifter – A mechanism, often incorporated onto a brake lever, that is activated by the thumb and forefinger to activate the shifting mechanism.

THANK YOU

This program was funded in part by a grant from the United States Department of Veterans Affairs. The opinions, findings and conclusions stated herein are those of the author(s) and do not necessarily reflect those of the United States Department of Veterans Affairs.

VA | U.S. Department of Veterans Affairs

DISABLED SPORTS USA

Thank you!

AUTHOR/EDITOR

David Lee, MS, CTRS/L
Northeast Passage
Durham, NH

CONTRIBUTORS

Greg Milano
BORP Cycling Program
Berkeley, CA

Patrick Addabbo
Adaptive Sports Center
Crested Butte, CO

Scott Moro
Ride2Recovery
Calabasas, CA

Connor Inslee
Outdoors for
All Foundation
Seattle, WA

Ian Lawless
Paralympic Cycling
Colorado Springs, CO

VA | U.S. Department of Veterans Affairs